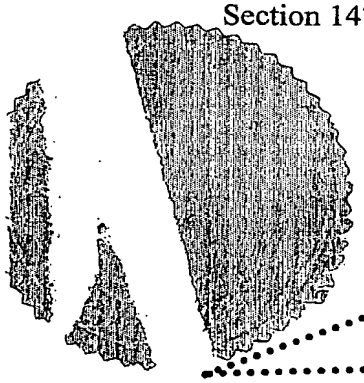
IN03/344

THE PATENTS ACT, 1970

IT IS HEREBY CERTIFIED THAT, the annex is a true copy of Application and provisional specification filed on 29.10.2002 in respect of patent application no. 936/MUM/2002 of Bajaj Auto Limited, an Indian Company, of Akurdi, Pune 411 035, Maharashtra, India.

This certificate is issued under the powers vested in me under Section 147 of the Patents Act, 1970.



Dated this 18th day of November 2003

M.A. Haafeez.

(M.A. HAAFEEZ)
ASST. CONTROLLER OF PATENTS & DESIGNS

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

FORM-1

(To be filed in Triplicate)

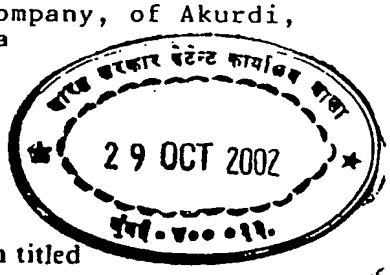
THE PATENTS ACT, 1970

(39 of 1970)

APPLICATION FOR GRANT OF A PATENT

[See Sections 5(2) 7, 54 and 135]

1. We BAJAJ AUTO LIMITED, an Indian Company, of Akurdi, Pune 411 035, Maharashtra, India



2. hereby declare-

(a) that ~~I~~ / We are in possessin of an Invention titled

Title IMPROVED TRANSMISSION SYSTEM FOR SCOOTERS

(b) that the Provisional / ~~Complete~~ Specification relating to this invention filed with this application.

(c) that there is no lawful ground of objection to the grant of a patent to~~me~~ / us.

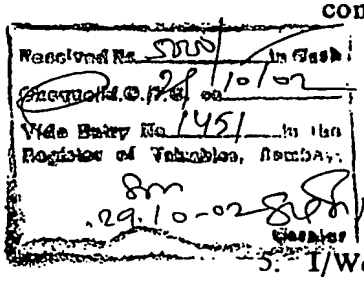
3. Further declare that the inventor(s) for the said invention is /~~are~~:

Surname first and then name of inventor/s

JOSEPH A, an Indian National, of BAJAJ AUTO LIMITED, Akurdi, Pune 411 035, Maharashtra, India

4. I/We, claim the priority from the application(s) filed in convention countries, particulars of which are as follows :

NIL



5. I/We state that the said invention is an improvement in or modification of the invention the particulars of which are as follows and of which I/We are the application/patentee:

NIL

936/MUM/2002
29/10/2002

936 | मुंबई MUM | 2002

ORIGINAL

6. I / We state that the application is divided out of my/our application, the particulars of which are given below and pray that this application be deemed to have been filed on.....
under section 16 of the act.

7. That I/am / We are the assignee of the true and first inventors.

8. That my / our address for service in India is as follows :

L.S. DAVAR & CO.
Monalisa, Flats IB & IC, 17, Camac Street,
Kolkata-700 017.
Phones : 247-3996, 247-5918, 280-5536
Fax No. : 91-33-247-5886, 240-6292
91-11-646-4443

9. Following declaration was given by the inventor(s) or applicant(s) in the convention country :
I / We the true and first inventors for this invention or the applicant(s) in the convention country declare that the applicant(s) herein is / are my / our assignee or legal representative.

Signature of the true and first Inventor/s or Applicant In the convenstion country with date, name to be given below Signature

JOSEPH A.

10. That to the best of ~~my~~/our knowledge, information and belief the fact and matters stated herein are correct and that there is no lawful ground of objection to the grant of patent to~~me~~/us on this application.

11. Following are the attachment with application :

(a) Provisional/Complete specification (3 copies).

(b) Drawings (Sheets) 3 copies.

~~(c) Priority document/s~~

(d) Statement and undertaking on Form 3 in dupl.

~~(e) Form 5.~~

(f) Power of Authority.

(g)

(h)

(i) Fee Rs.~~1,500/-~~ /Rs. 5,000/- in cheque / bank draft. bearing No.....date..... on.....Bank.

To be Signed by applicant or authorised patent agent

~~I~~/We request that a patent may be granted to me/us for the said invention.

Dated this 26th day of October 2002.

Signature ( )

(M.K. CHAKRABARTI)
OF L.S. DAVAR & CO.
AGENT FOR THE APPLICANTS.

To
The Controller of Patents
The Patent Office
at MUMBAI

FORM-2

THE PATENTS ACT, 1970

(39 of 1970)

PROVISIONAL/~~COMPLETE~~

SPECIFICATION

SECTION 10

ORIGINAL

TITLE

IMPROVED TRANSMISSION SYSTEM FOR SCOOTERS

APPLICANT

BAJAJ AUTO LIMITED, an Indian Company, of Akurdi, Pune 411 035, Maharashtra, India.

The following specification particularly describes the nature of the invention and the manner in which it is to be performed

This invention relates to a new transmission system employed for manual or automatically changing the gears in scooters, to enable the vehicle to be driven with different speeds and with varying load conditions. The invention is particularly converned with a compact three-shaft system, designed to achieve required ratio steps in a positive and efficient manner.

The object of the present invention is to have a transmission system which can be housed within the rear wheel rim of a scooter employing different wheel sizes, and to integrate an efficient gear shift mechanism. Such gear shift mechanism can be operated by hand or by foot or automatically, namely by electrical motor, solenoid actuated electrically/ hydraulically / pneumatically.

Scooters are driven by prime movers like thermal engine working on fuels i.e. gasoline, diesel or LPG. Scooters can also be battery operated. Since the vehicles on road has to negotiate different gradients with varying load conditions and at different speeds, they are provided with either manual or automatic transmission. The present scooter with manual gear-shift transmission consists of gears in constant mesh, which are laid on two shafts namely clutch shaft and the output shaft on which the rear wheel is mounted. The power flow from crankshaft to clutch shaft is effected through a primary gear reduction. In this known system, engine and transmission share the same

lubricating oil in case of engines working on four-stroke principle. The shifting is through cross selector mechanism operated through hand. In case of motor cycles, a known two-shaft transmission system is used namely clutch shaft and output shaft on which output sprocket is mounted. In order to have a 5-speed transmission, it is necessary to have 5 pairs of gear in constant mesh, each shaft having 5 gears.

A disadvantage of the conventional system is that the extreme angular travel of the twist grip where the scooter is large and at the extreme position, operation of the control switches provided on left side of handle bar is difficult. The difficulty increases further when there is a need to adopt 5 speed gear transmission.

Yet another difficulty in the known system is that in the case of engines working on four stroke principle, same lubrication oil is used for lubricating transmission parts and engine parts which is detrimental to the life of engine parts due to tiny particles generated in the transmission system which escape the filtration.

OBJECTIVES OF PRESENT INVENTION:

One of the objectives of the invention is to provide an improved transmission system for the scooters, which is compact in nature and can be accommodated within the rear wheel rim of the scooter.

Yet another objective of the invention is to provide an improved transmission system for scooters, in which gear shifting can be achieved through a hand operated or foot operated control system or which is done automatically, namely, electrical motor, solenoid actuated electrically / hydraulically / pneumatically.

Yet another object of the invention is to provide less angular travel of the twist grip (when shift mechanism is controlled by hand) with a resetting action easing gear shifting and operation of the control switches provided on left side of handle bar.

Still another objective of the invention is to use the same transmission system for different wheel sizes.

A still further objective of the invention is to provide an improved transmission system for scooters, which can provide for use of separate lubrication oil for engine and transmission parts in engines working on 4 stroke principle.

SUMMARY OF INVENTION

The invention is a compact three shaft system having nine gears in constant mesh (delivering five transmission ratios), three forks, one drum with three milled profiles on its outer periphery which converts the rotary motion of the drum to sliding motion of the respective forks for selection of appropriate

transmission ratio. Each drum profile will move a specific fork to achieve two ratio steps. The precise rotation of the drum is achieved through the shift mechanism, which resets to its original position after achieving every gearshift. The said shift mechanism can be operated either through hand, ie twist grip rotation / foot / depressing a gearshift switch (automatic).

The transmission system works in conjunction with clutch system mounted on the input shaft of the transmsision. The clutch system gets drive from the crankshaft through flexible linkage such as chain, belt, and drive shaft, to accommodate different center distances. This feature in conjunction with the invention can accommodate wide ratio to suit different wheel sizes. The transmission and clutch systems are lubricated by transmission oil. By adopting the new transmission system, engine oil and transmission oil can be separated, which results in increased life of engine components and clutch components.

Another embodiment of this invention is that the number of transmission ratios required can be varied by removing/modifying some components of the system, i.e. to get four transmission steps a specific fork, gear can be dispensed from the system without hampering overall system functioning.

DETAILED DESCRIPTION OF SHIFT MECHANISM AND TRANSMISSION SYSTEM

The present invention will now be described hereinbelow with reference to the accompanying drawing wherein

Fig. 1 illustrates the location of hand-operated clutch and gear shifting mechanism of the prior art.

Fig. 2 illustrates the flow of power in hand operated clutch and gear shifting mechanism of the prior art.

Fig. 3 illustrates another trasmission system of the prior art.

Fig. 4 illustrates the transmission system as per the invention (in side view).

Fig. 5 illustrates the section view ABCDBE of transmission system as shown in Fig. 4.

Fig. 6 illustrates the power flow through transmission system as per the invention.

Fig. 7 illustrates shift control system operated by hand.

Fig. 8 illustrates shift control system operated by foot.

With reference to Figs. 1 and 2, the operation of the clutch is done by depressing the lever (1). The clutch is disengaged when lever (1) is depressed and on releasing the lever, the clutch is

engaged. The gear shifting is achieved by means of rotating the twist grip (2) in a clockwise or counterclockwise direction depending upon the gear to be selected by applying twisting effort on lever (1). The rotation of the twist grip (2) about the Axis A3 moves the pin (3) axially, through control cables (not shown). A cross (4) is located inside the main shaft (9) and is attached to other end of the pin (3). Depending upon the position of the twist grip (2), the cross will match with one of the gears (5,6,7 or 8) and the motion is transmitted to the main shaft (9) on which the rear wheel (not shown) is fitted.

As can be seen in the fig 2, if gear (8) is to be engaged, the pin (3) has to be pushed so that cross (4) matches with gear (8). This is achieved by twisting the grip (2) with the help of lever (1) in anti-clockwise direction when looked from left side of the vehicle. In this case, the angular position of the twist grip is undesirably high and is very uncomfortable when shift of gear is desired from gear (8) to gear (7) and to operate the control switches. When a particular gear is engaged, this position of the cross (4) needs to be locked in its position till a further shift is made. This is achieved by means of ball (10) and grooves (11) on the pin (3).

As explained above the gear shifting control is in conjunction with clutch control and the shifting is achieved by rotating of the twist grip. The twist grip angular travel depends on nubmers of gears provided on the vehicle.

With reference to Fig.3, which illustrates a known two-shaft transmission system used in a motor cycle namely clutch shaft (15) and output shaft (16) on which output sprocket (17) is mounted. In order to have a 5-speed transmission, 5 pairs of gear in constant mesh are required, each shaft having 5 gears.

The improved transmission system for the scooters essentially comprises of gear shifting lever assembly (30), gear shift lever (31) with a slot (32) and bent lug (39), a stopper pin (33) mounted on crankcase (34), gear shifting pin (35) with projections (36), drum assembly (37) with milled profiles (52,53 and 54), inhibitor (38), compression spring (41), sector plate (42), input shaft (43), an intermediate shaft (44), an output shaft (45), input fork, dog gears (47,49 and 51), intermediate fork (48), output fork (50), slotted gears (55, 56, 57 and 58), gear (59) the twist grip (60), torsion spring (61), needle roller bearings (62), cables (63 and 64), gear control link (65).

The improved transmission system for scooters according to the invention and the working thereof is explained in the following paragraphs in three main sections. The first section explaining the transmission gear box and the second section explaining the control mechanism. The third section explains the emboldiments of the invention.

Section 1

With reference to Figs 4 and 5,the gear shifting mechanism as per the invention comprises of gear shifting lever assembly (30), whcih can rotate in both the directions about the axis 01. The gearshift lever (31) has a slot (32) to restrict its angular motion in both direction in conjunction with a stopper pin (33) which is mounted on crankcase (34). The rotary motion of gearshift lever (31) is transmitted to gear shifting pin (35) through lanced projections (36) on the gear shift lever (31).

The gear shifting pin (35) in turn rotates the drum assembly (37) through splines / sliding key. To prevent overshifting of the drum assembly (37), it is locked after every shift using inhibitor (38), which is spring loaded. In addition to this a bent lug (39) is also provided on gearshift lever (31) to prevent overshifting.

The reset motion of the gear shift lever assembly (30) is achieved by a double acting torsional spring (40) mounted on the gear shift lever assembly (30). While resetting, the cam surface on the gearshift lever (31) pushes the gear shifting pin (35) down to clear itself, and ready for the next shift. The gear shifting pin (35) springs back to normal position with the help of compression spring (41). The rotary motion to the gear shift lever assembly (30) is provided through the sector plate (42)

fastened to gear shift lever assembly (30). The sector plate (42) can be operated either by hand / foot through gear shifting cables / linkages. The direction of rotation of gearshift lever assembly (30) determines direction of rotation of drum assembly (37), which determines a specific fork selection for axial travel.

The transmission system, is a compact three shaft system, namely, a input shaft (43), an intermediate shaft (44), an output shaft (45) on which the rear wheel (not shown) is mounted. Each shaft is supported rigidly on bearings.

The transmission system comprises of nine gears (three gears on each shaft 43, 44 and 45) in constant mesh. The gears are smaller in size and thereby gears rotational inertias are less. The system is provided with three forks, each one of them moves axially to and fro a specific dog gear on the shaft. The forks are designated as input fork (46) which moves the dog gear (47) sliding on the splines provided on the input shaft (43), the intermediate fork (48) which moves the dog gear (49) sliding on the splines provided on the intermediate shaft (44), the output fork (50) which moves dog gear (51) sliding of the splines provided on the output shaft (45). The drum assembly (37) has three milled profiles (52, 53 and 54). The forks (46, 48 and 50) engage with profiles (54, 52 and 53) respectively on the drum assembly (37).

The power from the crankshaft is given to the input shaft (43) which is integral with gear (43a) on which clutch (not shown) is mounted through flexible linkage namely chain or belt or shaft drive.

The five speed transmission system functioning will be explained below with reference to Figs 5 and 6.

First gear ratio - To obtain the first gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction which rotates the drum assembly (37). The intermediate fork (48) engaged with profile (52) on drum assembly (37), moves axially to right, resulting in movement of dog gear (49) to right and engaging the slotted gear (55). This completes one gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in first gear is as below.

Input shaft (43) with integral gear (43a) - slotted gear (55) - dog gear (49) - dog gear (51) - output shaft (45).

Second gear ratio - To obtain the second gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction with rotates the drum assembly (37). The intermediate fork (48) engaged with the profile (52) on drum assembly (37),

moves axially to right, resulting in movement of dog gear (49) to left and engaging the slotted gear (56). This completes second gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in first gear is as below

Input shaft (43) with integral gear (43a) - slotted gear (55) - dog gear (49) - dog gear (51) - output shaft (45).

Second gear ratio - To obtain the seconde gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction which rotates the drum assembly (37). The intermediate fork (48) engaged with the profile (52) on drum assembly (37), moves axially to left, resulting in movement of dog gear (49) to left and engaging the slotted gear (56). This completes second gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in second gear is as below

Input shaft (43) with integral gear (43a) - dog gear (47) - slotted gear (56) - dog gear (49) - dog gear (51) - output shaft (45).

Third gear ratio - To obtain the third gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction which rotates the drum assembly (37). The output fork (50) engaged with the profile (53) on drum assembly (37), moves axially to right, resulting in movement of dog gear (51) to right and engaging the slotted gear (57). This completes third gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in third gear is as below

Input shaft (43) with integral gear (43a) - slotted gear (55) - slotted gear (57) - dog gear (51) - output shaft (45).

Fourth gear ratio - To obtain the fourth gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction which rotates the drum assembly (37). The output fork (50) engaged with the profile (53) on drum assembly (37), moves axially to left, resulting in movement of dog gear (51) to left and engaging the slotted gear (58). This completes the fourth gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in fourth gear is as below.

Input shaft (43) with integral gear (43a) - dog gear (47) - slotted gear (56) - slotted gear (58) - dog gear (51) - output shaft (45).

Fifth gear ratio - To obtain the fifth gear ratio, the gearshift lever assembly (30) is rotated in a predetermined direction which rotates the drum assembly (37). The input fork (46) engaged with the profile (54) on drum assembly (37), moves axially to right, resulting in movement of dog gear (47) to right and engaging the gear (59). This completes fifth gear ratio selection and the shift lever assembly (30) resets to its original position, and the drum assembly (37) is locked after gear ratio selection by inhibitor (38). The power flow in fifth gear is as below

Input shaft (43) with integral gear (43a) - dog gear (47) - gear (59) - dog gear (49) - dog gear (51) - output shaft (45).

In the above invention, to obtain a 4-speed transmission gear (59), input fork (46) are dispensed without hampering overall system functioning.

The power from the crankshaft to the clutch shaft can be given through either a chain or through belt or any other suitable means.

Section 2

The rotary motion can be imparted on the sector plate (42) by rotation of the twist grip by hand as shown in Fig 7. In this invention, the resetting of gearshift lever assembly (30) in turn

resets the twist grip (60) to its preset position after every gearshift is achieved. This eases the operation of clutch. control switches namely direction indicator. Invention incorporates additional torsional spring (61), needle roller bearing (62) on the handle bar barrel, to have friction free and positive resetting of the twist grip (60). The number of ratio steps intended will dictate the number of times the twist grip (60) can be rotated ine ach direction. For example, if intended to have five transmission ratios, the twist grip (60) can be rotated in both the directions, each, five times only. The direction of rotation of twist grip (60) determines whether it is upshift or downshift. In the above situation, it is five times upshift in one direction and five times downshift in the opposite direction of the twist grip (60). The rotation of the twist grip (60) is transmitted to the sector plate (42) through cables (63 and 64) mounted on gear control link (65).

Section 3

Alternatively the rotary motion can be imparted on the sector plate (42) by rotation of the lever (21) by foot as shown in Fig 8. In this invention, the resetting of gearshift lever assembly (30) in turn resets the lever (21) after every gearshift is achieved. The number of ratio steps intended would dictagte the number of times the lever (21) can be rotated in each direction.

For example, if intended to have five ratio steps, the lever (21) can be rotated in both directions, each, five times only. The direction of rotation of lever (21) determines whether it is upshift or downshift. If we take the above case, it is five times upshift in one direction and five times downshift in the opposite direction of the lever (21). The rotation of the lever (21) is transmitted to the sector plate (42) through cables (25 and 25a) are alternatively by suitable linkages.

The rotary motion can be imparted on the sector plate (42) with the help of double actuating solenoid, which is actuated electrically, hydraulically or by pneumatic means.

The improved transmission system of the two wheeler as described herein and as illustrated in the drawings is not exhaustive. Any improvement and/or modification of such transmission system which are within the knowledge of a person having average skill in the art are covered by this invention.

Dated this 26th day of October 2002.

(M.K. CHAKRABARTI)
OF L.S. DAVAR & CO.
AGENT FOR THE APPLICANTS.

BAJAJ AUTO LTD.

PROVISIONAL SPECIFICATION

8 SHEETS
SHEET 1

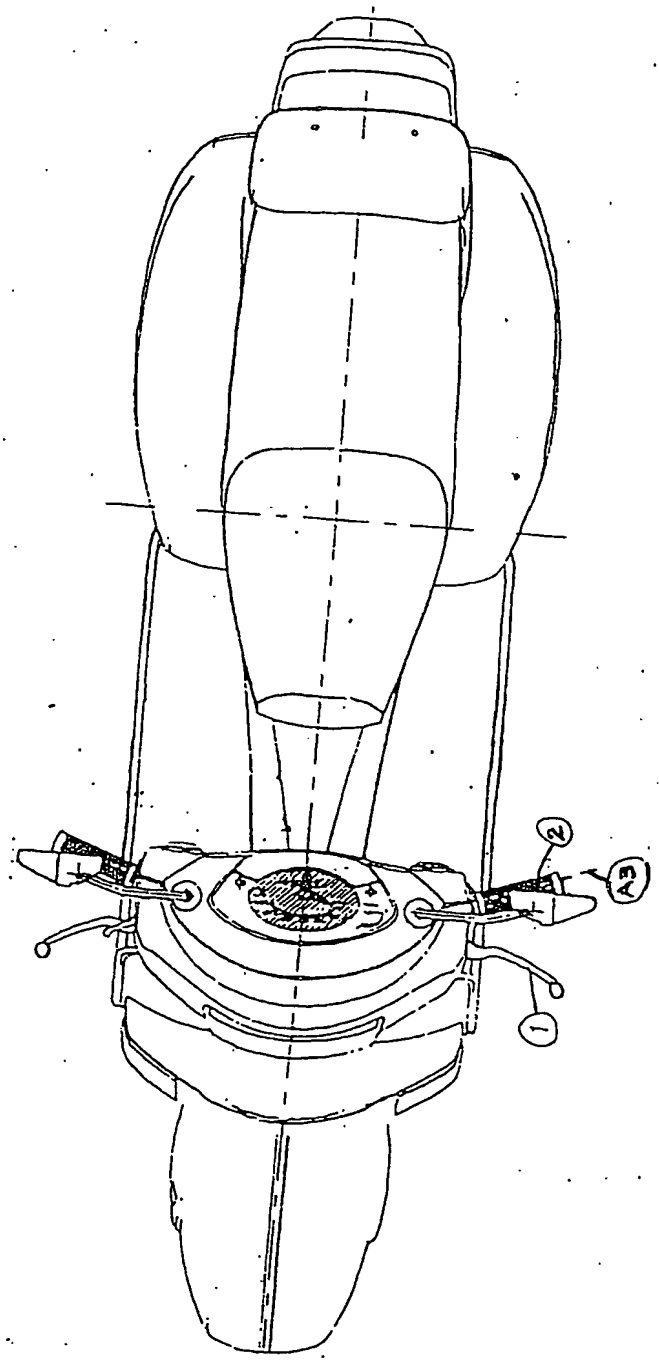


Fig. 1

(M. K. CHAKRABARTI)
OF L. S. DAVAR & Co.
APPLICANTS' AGENT

29 OCT 2009

BAJAJ AUTO LTD.

8 SHEETS
SHEET 2

PROVISIONAL SPECIFICATION

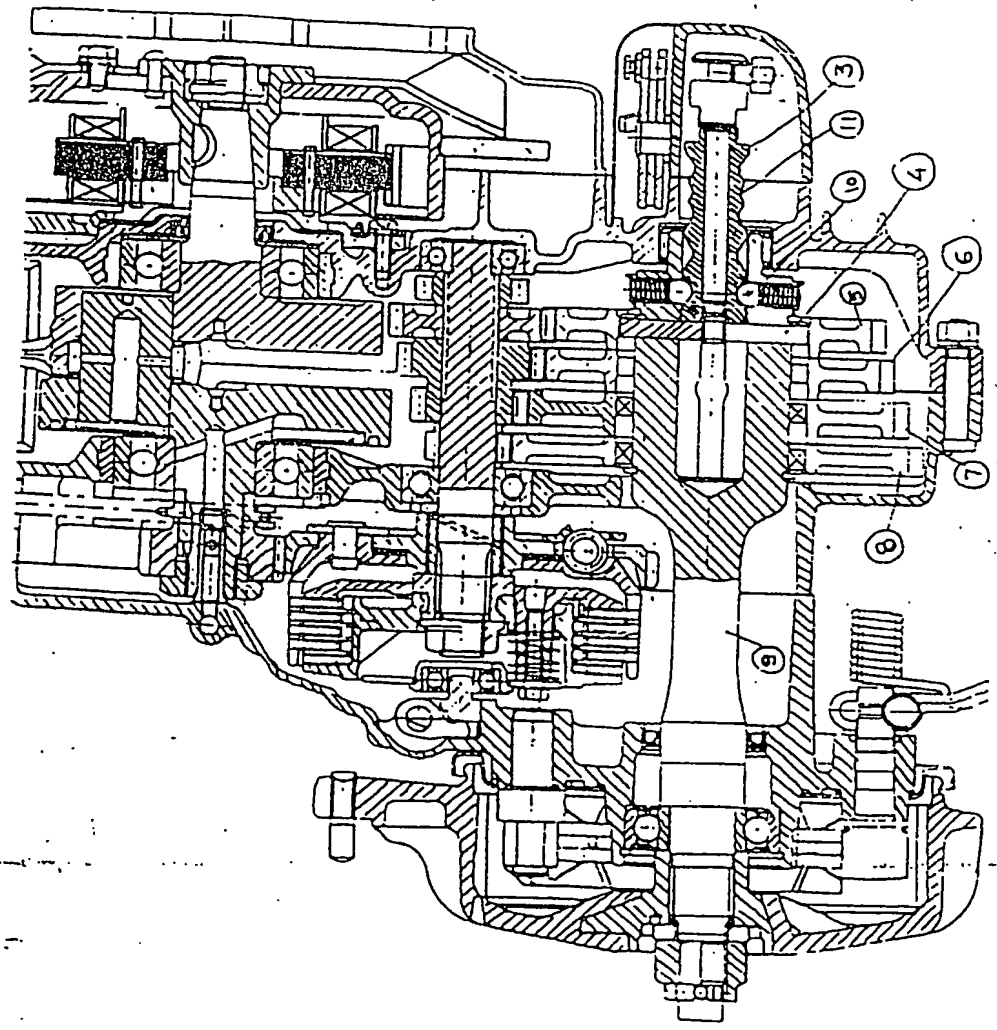


Fig. 2

(M.K. CHAKRABARTI)
OF L.S. DAVAR & Co.
APPLICANTS' AGENT

19 OCT 2002

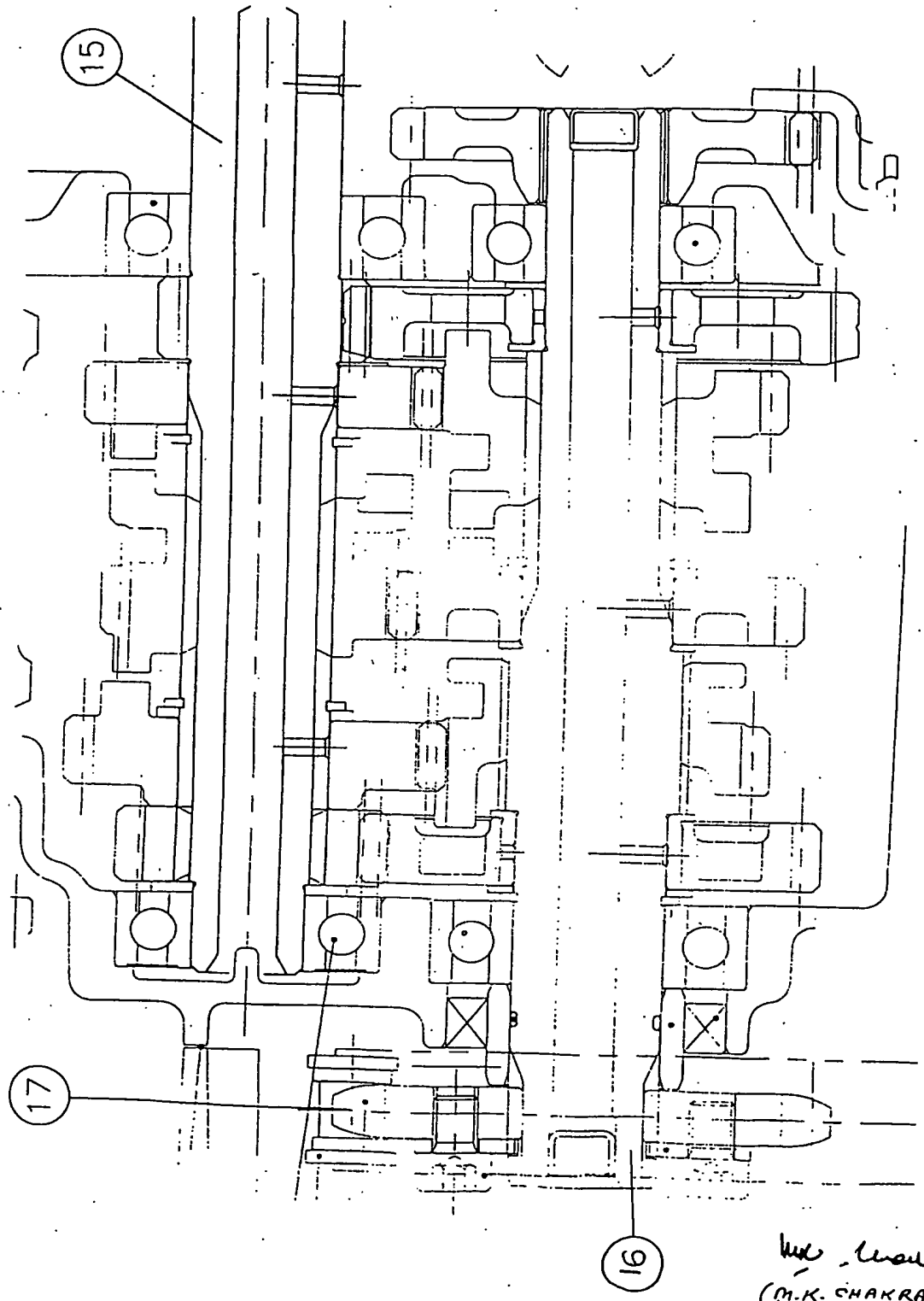


Fig. 3

(M.K. CHAKRABARTI)
OF L.S. DAVAR & CO.
APPLICANTS' AGENT

BAJAJ AUTO LTD.

PROVISIONAL SPECIFICATION

8 SHEETS
SHEET 4

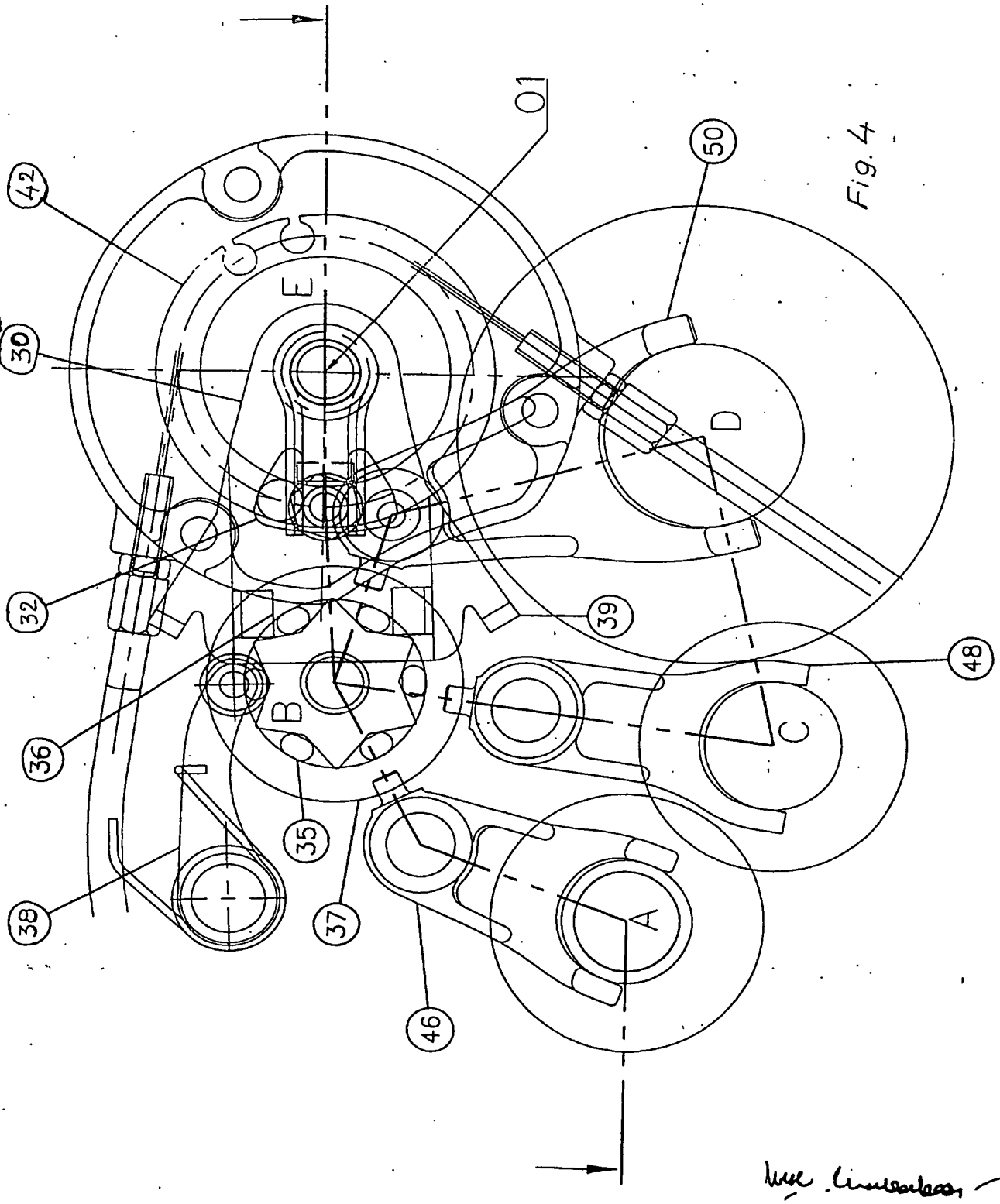


Fig. 4

(M. K. CHAKRABARTI)
OF L. S. DAVAR & Co.
APPLICANTS' AGENT

29 OCT 2008

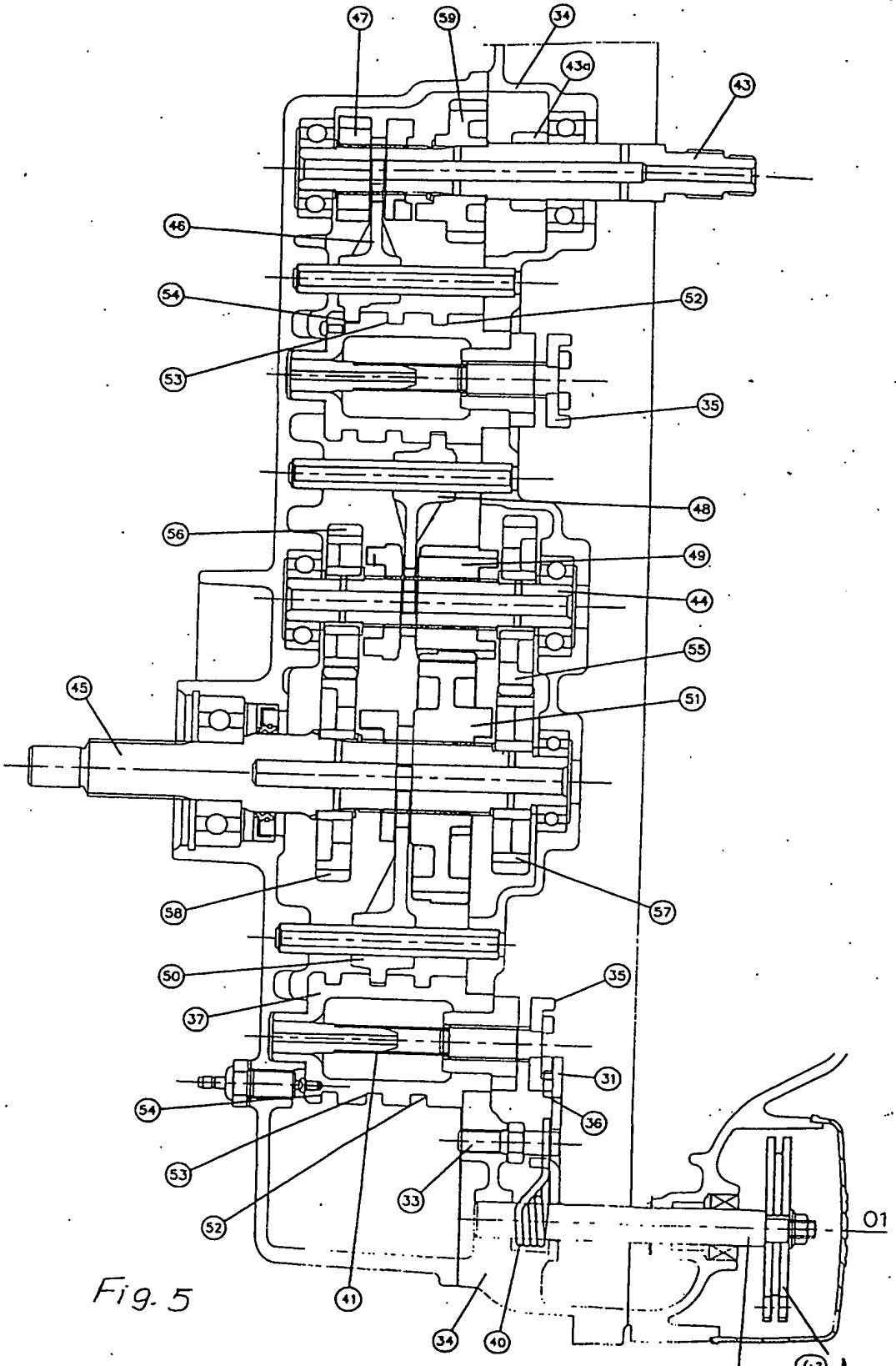


Fig. 5

29 OCT 2002

(M.K. CHAKRABARTI)
OF L.S. DAVAR & CO.
APPLICANTS' AGENT

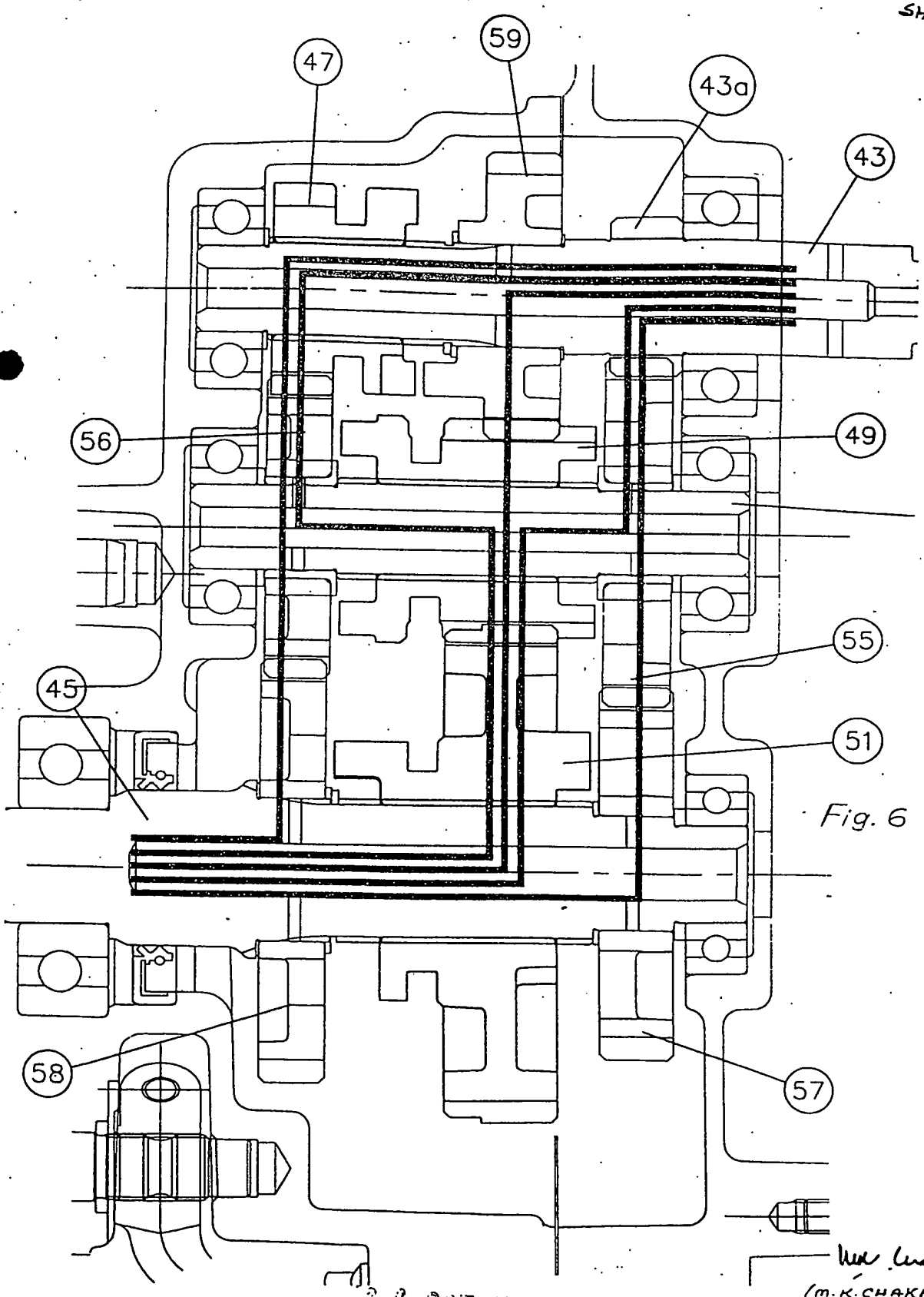


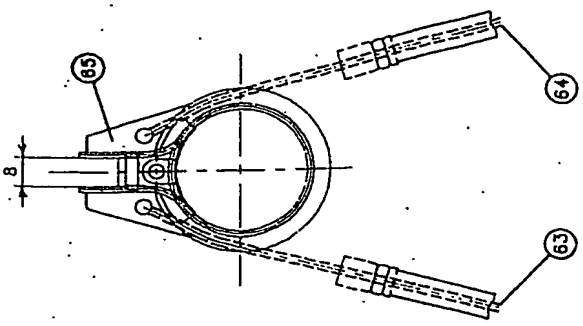
Fig. 6

(M.K. CHAKRABARTI)

BAJAJ AUTO LTD.

8 SHEETS
SHEET 7

PROVISIONAL
SPECIFICATION



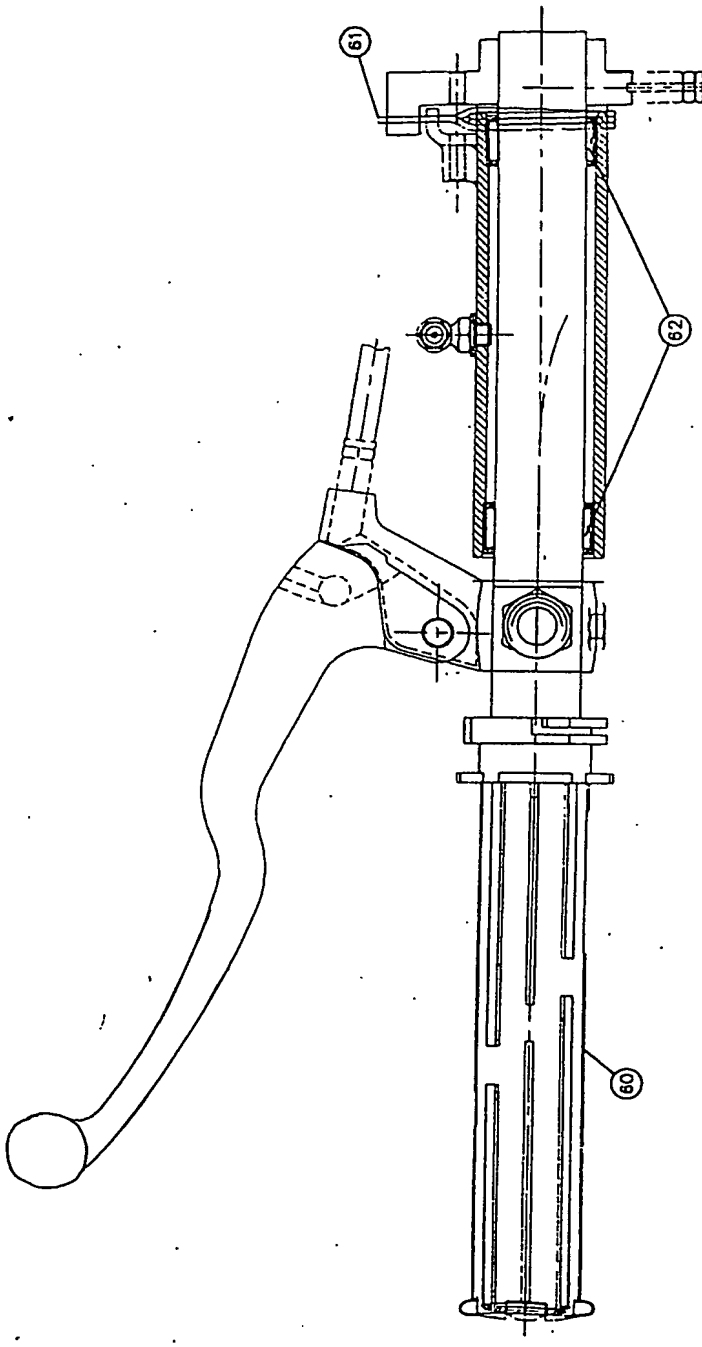


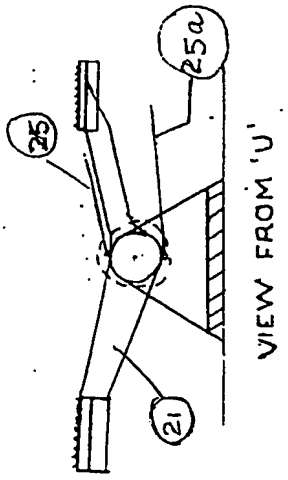
Fig. 7

(M. K. CHAKRABARTI)
OF L. S. DAVAR & Co.
APPLICANTS' AGENT

BAJAJ AUTO LTD

8 SHEETS
SHEET 8

PROVISIONAL SPECIFICATION



VIEW FROM 'U'

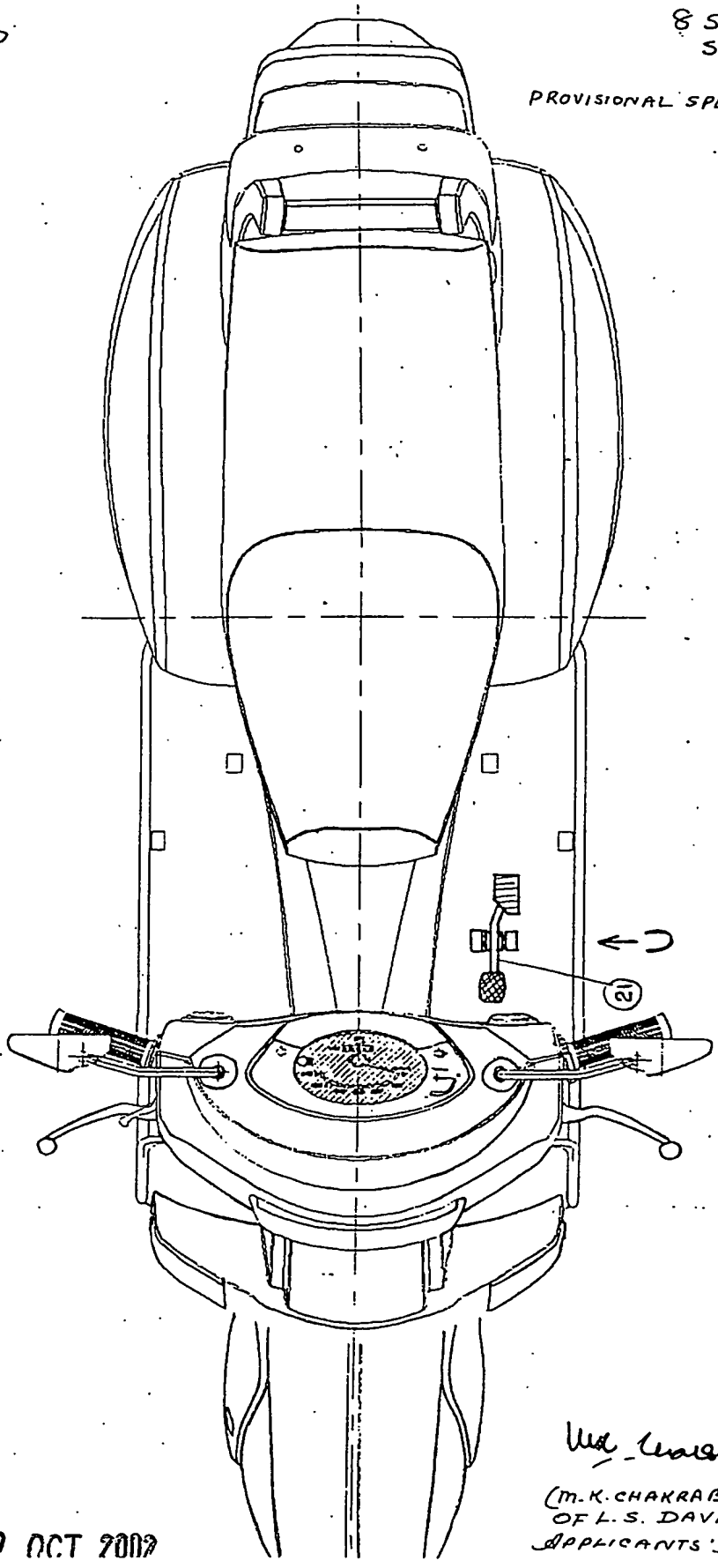


FIG-8

(M. K. CHAKRABARTI)
OF L. S. DAVAR & Co.
APPLICANTS' AGENT

29 OCT 2002